

MOBILE DATA APPLICATIONS

MOTOROLA LTD

EUROPEAN CELLULAR SUBSCRIBER DIVISION

INPUT

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O C T O B E R 1 9 9 1

THE MARKET FOR MOBILE DATA APPLICATIONS

A Report for

Motorola Ltd.

European Cellular Subscriber Division

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Chineham, Basingstoke

Hampshire RG24 0NA

From

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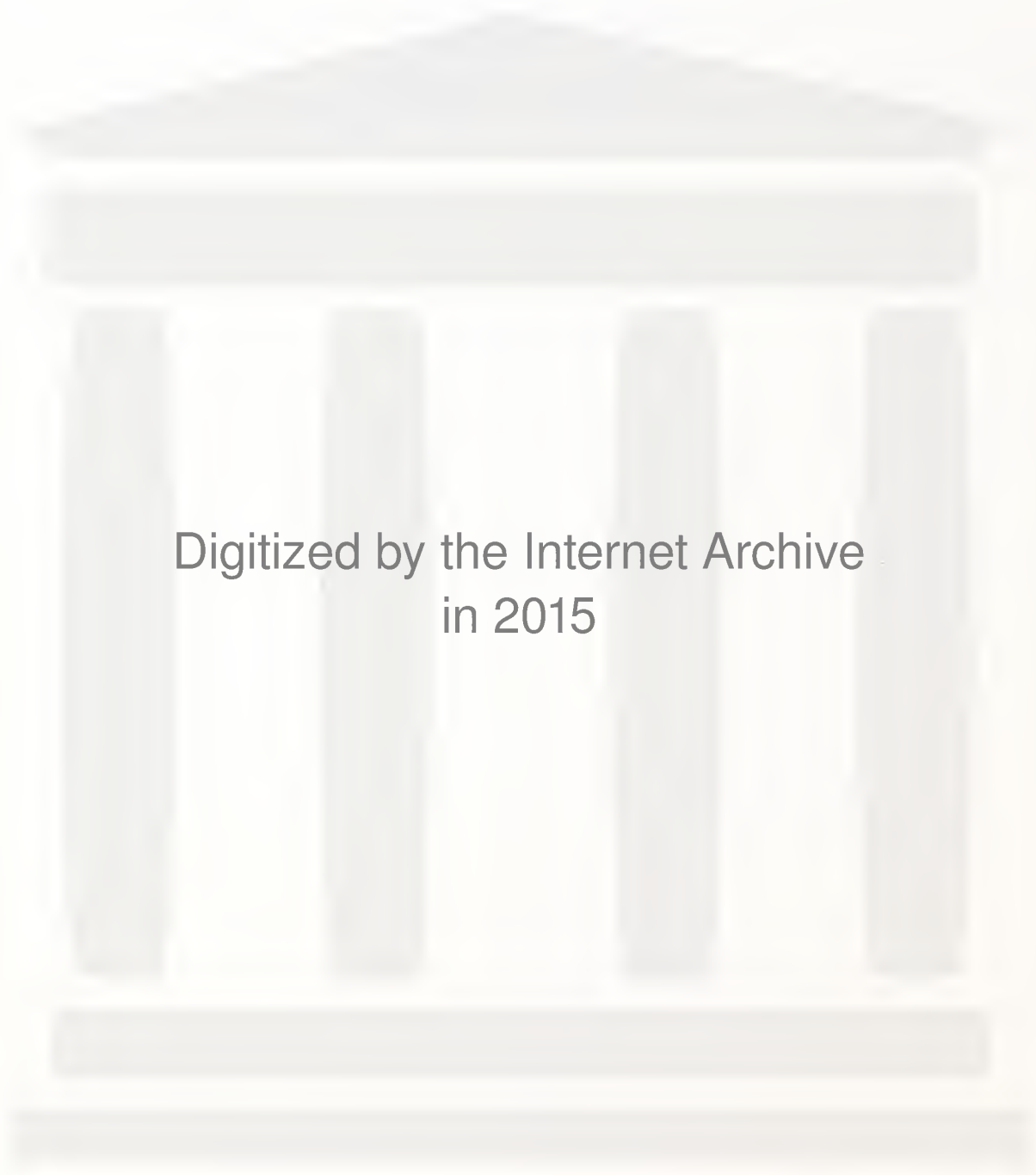
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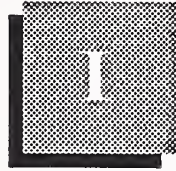
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Introduction





Introduction

A

Objectives

The objective of this study is to provide a short report indicating the types of partners with whom relationships might be set up by Motorola to further its penetration of the European market for mobile communications products and services.

The detailed aims of the research include:

- Identifying and profiling the major players in the European and world-wide markets for mobile data
- Defining applications for mobile data and identifying the needs and types of customers in each segment
- Estimating the market size and growth potential in Europe and world-wide, analysing the market to cover the key sectors of analogue cellular and GSM cellular
- Investigating a number (5) of vendors selling equipment and services into adjacent markets such as facsimile, laptop and notebook computers and profiling these vendors in such a way as to illustrate their worth as potential partners for Motorola.

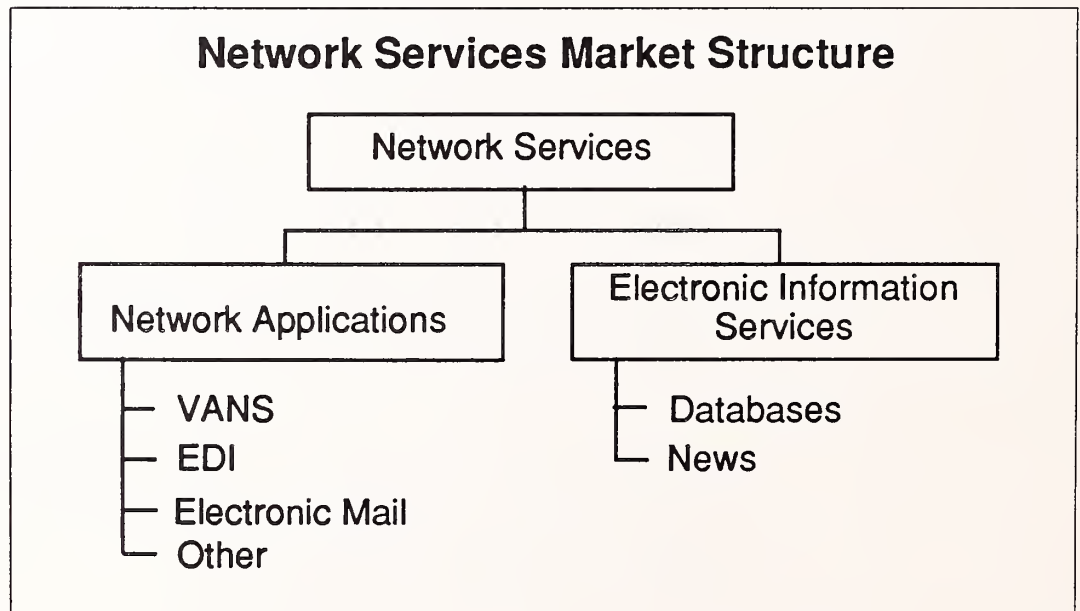
B**Methodology and
Conduct of the Study**

The methodology adopted was to incorporate this research project into INPUT's Network Services Programme which tracks Western European developments in the market for network-based services of all types. INPUT segments the network services market into:

- Network management services (which includes Managed Network Services - MNS)
- Enhanced services (sometimes called Value-Added Network Services - VANS), such as protocol conversion, store and forward, error correction and gateway services
- Network applications, which include electronic mail, EDI and industry-specific services such as financial trading, or insurance quotations
- Electronic information (EI) services which give access to host databases and integrated news services, such as those provided by Reuters, Extel and Mead

Exhibit I-1 illustrates the programme's market structure.

EXHIBIT I-1

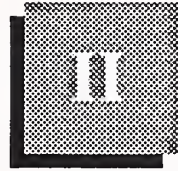


Vendor research was conducted by telephone in the week commencing 19 August 1991, and the results were analysed and written up in the week commencing 26 August 1991 for delivery to Motorola on or before Friday, 30 August 1991.



Executive Overview





Executive Overview

A

Mobile Data Communications Markets

The market for mobile data communications consists of two elements:

- Subscriber expenditure on equipment and services
- Provider expenditures on infrastructure equipment

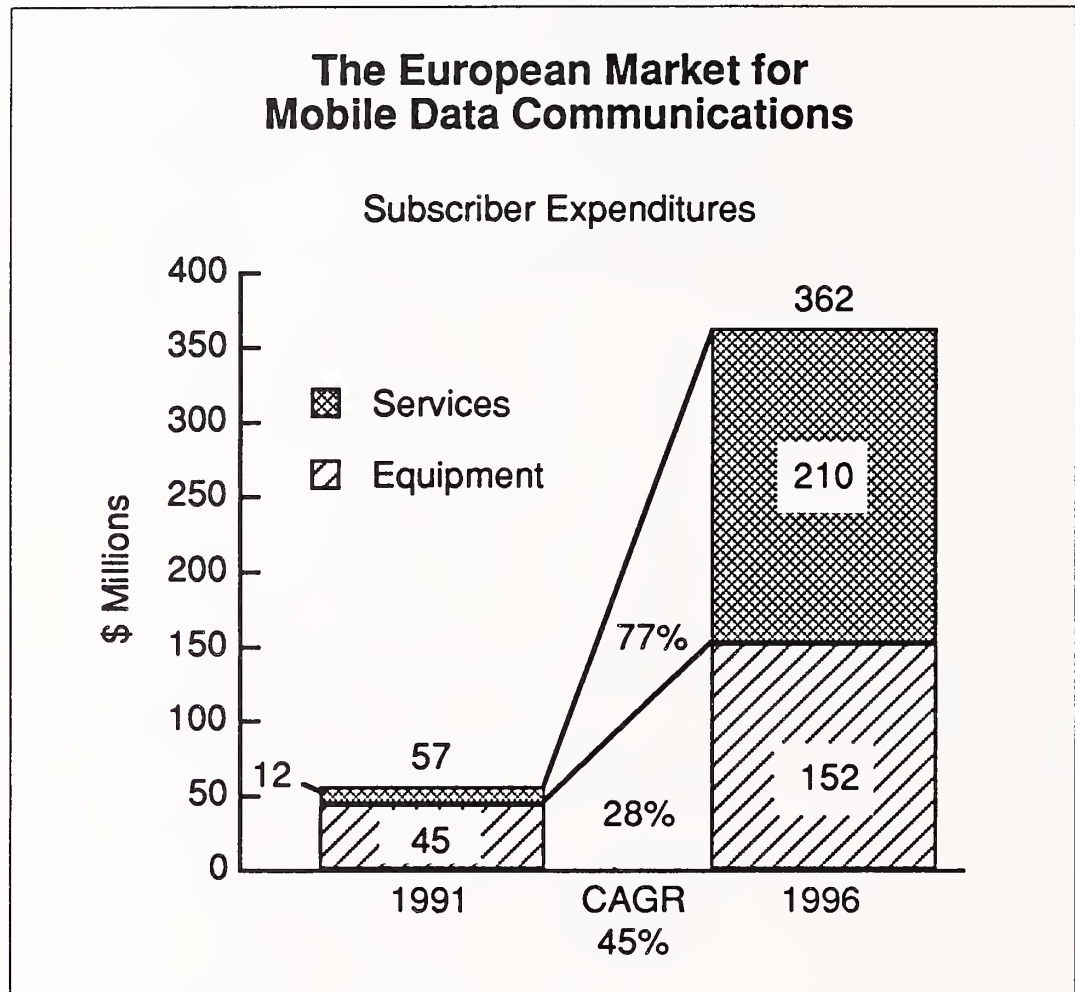
The justification for network operators and service providers investing in infrastructure construction is that they can recoup their investments through profitable provision of services to subscribers.

When new network services are being designed or planned, the investments needed up front cause large expenditures to be required from operators and providers. This can cause a bulge in expenditure on equipment—exchanges, base stations, and network management systems, for example—before any subscriber revenues start to show up. These investment expenditures are not counted by INPUT as part of the subscriber market size, since INPUT measures all its continuously tracked markets at the final user expenditure interface. The subscriber demand is regarded as the true measure of the market.

This report, therefore, has excluded from the market sizing and forecasting exercises any expenditures on infrastructure equipment.

Exhibit II-1 shows the European market for mobile data communications (subscriber expenditures). From the small base of under \$60 million in 1991 it is forecast to grow at an average of 45% per annum over the next five years to reach over \$360 million by 1996. Currently, subscriber equipment expenditure accounts for over 75% of the market. Network usage fees (the services element of the market) are very small, since many countries have still to initiate a significant range of services which are publicly available on a commercial basis.

EXHIBIT II-1



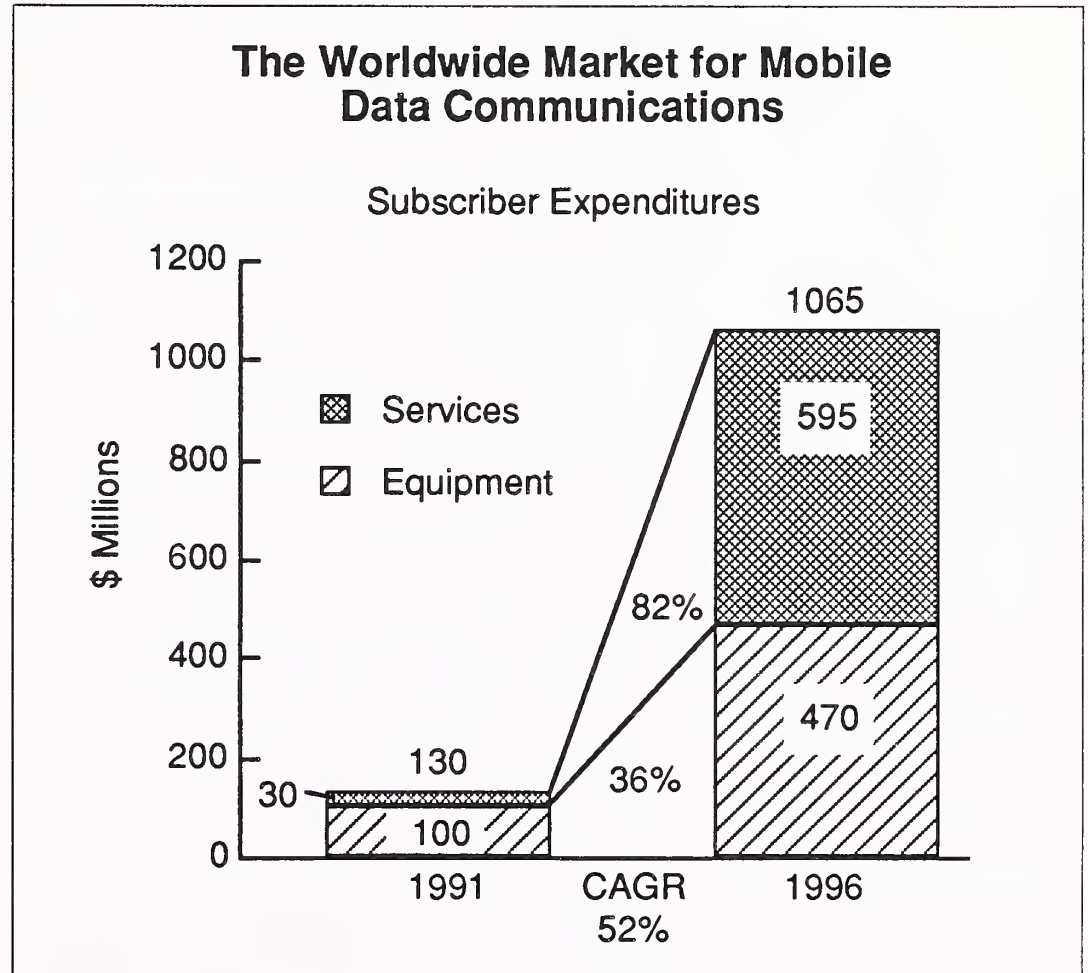
By 1996 the services element is forecast to have overtaken the subscriber equipment element in terms of expenditure. The growth in the services component and the relatively slower growth in equipment is due to:

- Many subscribers will use standard portable computers as their terminal device.
- Prices for specialist mobile data input/output terminals, e.g., fax or messaging terminals, will fall.
- In some cases terminals will become a free-of-charge “entry” device whose cost is included in subscriber fees.

The study has defined Europe to include Eastern European countries—Poland, Czechoslovakia, Hungary, Romania and Yugoslavia—but excludes Russia and the emerging Baltic States.

Exhibit II-2 shows a similar chart for INPUT's estimate of the growth of subscriber expenditures on a worldwide basis for mobile data communications.

EXHIBIT II-2



It should be emphasised that these forecasts are INPUT's preliminary forecasts for this new market sector. They will be reworked as a component of our Network Services market forecast to be published in the autumn of 1991. Appendix A describes the methodology and assumptions behind INPUT's standard published market forecasts. The thinking which went into the current estimates made for this report is described in more detail in Chapter III.

B

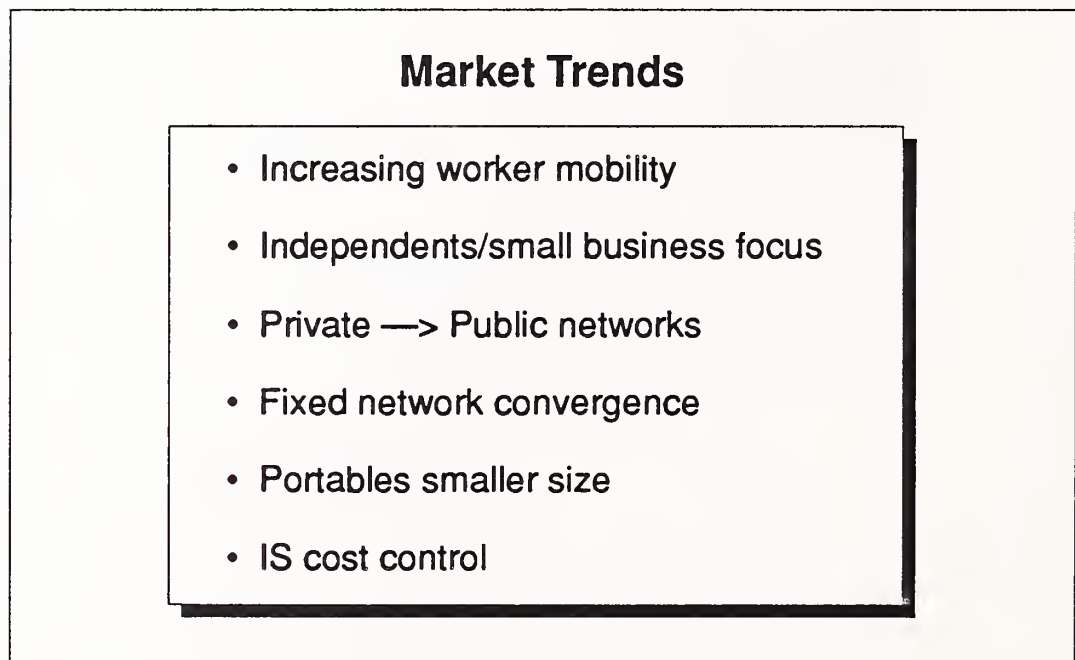
Key Issues and Trends

A number of trends are at work in the information systems and services industries which impact the development of mobile data (see Exhibit II-3):

- Workers move about more.
- More small business and independent professionals are working in the economy.

- Telecommunications managers in user organisations are moving more to the outsourcing of their networks.
- Improvements in the trunking links of the fixed networks are increasing the significance of their cost/effectiveness to adjacent sectors such as mobile and satellite.
- Portable computers are shrinking from “laptops” to “notebooks” to “palmtops.”
- Information systems managers are looking for better ways of controlling their costs and making further savings.

EXHIBIT II-3



The key issues for Motorola in assessing market prospects for mobile data divide into two types:

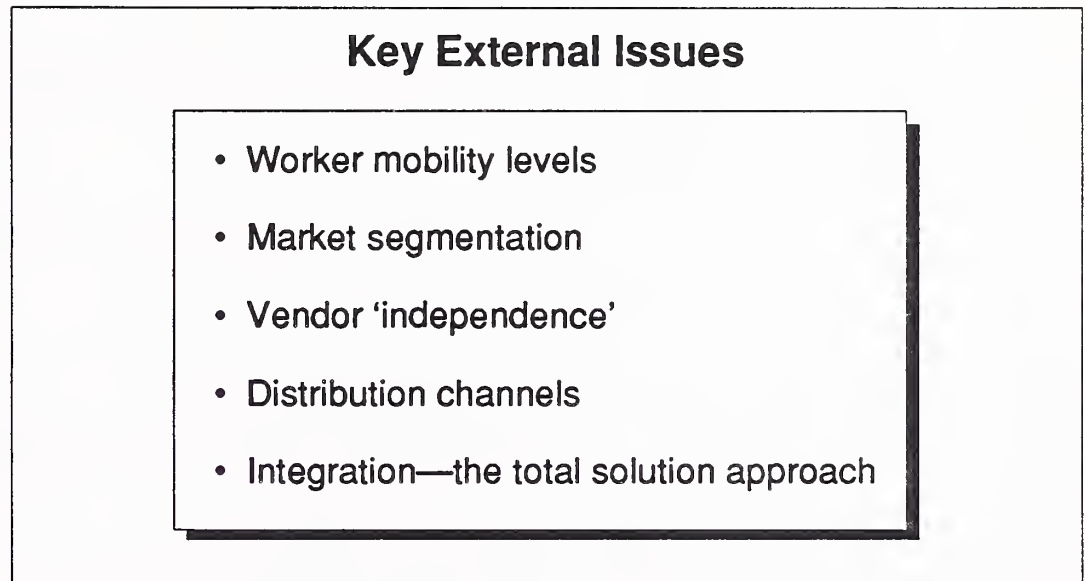
- External market issues (see Exhibit II-4)
- Internal policy issues (see Exhibit II-5)

Market assessments depend upon:

- How constantly in touch do mobile workers need to be?
- What segmentation will the market adopt when it matures?
- How independent of large vendor influence do users wish to remain?

- How can distribution channels be best used?
- Today's users' demands for solutions and not merely equipment.

EXHIBIT II-4



Motorola's policy for mobile data communications in the 1990s needs to take account of organisational factors:

- Needing to redefine its market position. The market leader can lose edge through fragmentation and consequent self-impact, a fate which IBM has worked very hard to avoid.
- Voice communications demands a different sales and marketing culture to data communications, due mainly to the software component in the data side and its smaller consumer market element.
- Establishing the correct equipment and services portfolio and gaining synergy from its breadth or comprehensiveness.
- Using the market need for a systems integration service to potentially increase the synergies between the different parts of Motorola's mobile data activities—the issue of focus.

EXHIBIT II-5

Key Internal Issues

- Motorola positioning
- Sales and marketing cultures
 - Voice vs. Data
 - Personal vs. Business markets
- Equipment/Services mix
- Integration synergy

C**Conclusions**

INPUT concludes that selecting one or more partners could prove beneficial in furthering Motorola's penetration of the worldwide and European markets for mobile data communications. The caveat that we would make is that it should be done within the framework of an overall strategy for this marketplace. Without knowledge of that framework, INPUT can only select candidates and describe them. We are not in a position to recommend one type of partner over another, nor in the limited time at our disposal, to produce an extract from an exhaustive list of possible candidates. Nevertheless, the work on profiling vendors in adjacent sectors which has been undertaken for this study should serve as useful input to the formation of a strategic plan for the sector.

Exhibit II-6 lists some criteria against which candidates will need to be judged, under the headings of:

- Production capabilities
- Marketing methods and coverage
- Company factors

EXHIBIT II-6

Choice of Partner(s)

- **Production:**
 - I/O units
 - Applications
- **Marketing:**
 - Channel control
 - Geographic coverage
 - Industry expertise
- **Company:**
 - Financial resources
 - R&D status
 - Image

D**Recommendations**

Any selection of partners, in what is currently an emerging and, therefore, confused and fragmented market, should be made in the light of the priorities put on penetration of the different segments of the mobile data market:

- Infrastructure equipment
- Subscriber connection and terminal equipment
- Subscriber network services
- Ancillary software and consultancy sectors
- Maintenance and customer support services
- Network management services

Motorola is recommended to research the selection of partners more fully than has been possible during the two weeks of this present project. So far the vendors examined have all been operating in the adjacent sectors for subscriber terminal equipment:

- Facsimile devices
- Hand-held and portable data capture units
- Laptop and notebook personal computers

The choice of solutions offered to the user will remain confusing during the next five years as competing technologies mature and come to market. There will be a market need for a systems integration service which should include all or some of the following elements.

- Business analysis and consultancy
- Equipment selection
- Application software and support

- Network services selection
- Network services provision (on a temporary or a permanent basis)
- Network management
- Customer services and maintenance

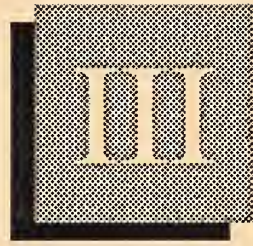
The essential ingredient for a flexible integration service is to be able to tailor the requirements of each prospective client according to how much of each type of service is appropriate, i.e., to mix and match to the client's needs.

Offering such a service could provide the correct strategic focus for Motorola's comprehensive set of interests in the mobile data area. IBM has pursued such a policy in the information services business and now earns almost \$0.5 billion in Europe alone from large systems integration contracts. Exhibit II-7 summarises INPUT's recommendations.

EXHIBIT II-7

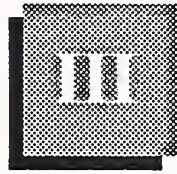
Recommendations

- Determine strategic approach
- Research partners fully
- Focus via integration and consultancy



Market Analysis





Market Analysis

A

Issues and Trends

The market for mobile data communications overlaps with three other adjacent market sectors:

- Voice mobile communications, which provides the major technological drivers for the market
- Portable computer applications which have been increasing in importance as data processing becomes more distributed
- Office automation, in which the rapid growth of facsimile as a day-to-day essential business tool raises the possibility of its extension into the service of mobile workers

Motorola has the focus of its mobile communications business firmly in the first of these three sectors. INPUT has been researching the activities of companies in the other two markets in order to discover vendors who might be useful as partners in the emerging market for mobile data as distinct from mobile voice communications.

The major issues for Motorola at this juncture of its and the market's development are:

- How mobile do business users of mobile data really need to be? And how immediately do they need to be in touch with their internal organisational database or with external databases? This governs the sector's underlying demand pull.
- Where does Motorola wish to be in the market, bearing in mind that the mobile data market has very different characteristics from that for voice? Can Motorola adjust to a new role if need be?

- Following from the answers to other issue questions, what distribution policy does Motorola find acceptable to itself, seeing that the IS (information services) marketplace is now demanding solutions, not merely equipment?
- What is the segmentation of the mobile data communications sector? This issue has exercised the minds of telecommunications pundits but the segmentations suggested—by technology, network type, user type, applications area, industry sector—all seem to lead to a fragmented, confused view of the market.
- Is the sales and marketing culture required for success in the emerging mobile data market markedly different from that in voice mobile communications? INPUT believes that in the mobile data area the sale is more to an organisation (and into organisations of varying sizes) than to the individual. Justification is by each business case, not by individual productivity as has been the case with cellular voice.
- How independent of any one equipment supplier should a mobile system supplier be? In a market where different types of solutions are in competition with each other the user may wish to have guidance from an independent source. This is particularly true over the standards issues. Data processing and data communications have made vast strides towards open systems for implementation of multivendor solutions. Radio communications is now converging on data communications with another raft of new standards. This inevitably increases users' defensiveness in the face of new offerings.
- INPUT believes that mobile, radio data systems will need to be integrated into users' existing data communication networks and systems. Someone must take the responsibility for this integration:
 - *The user* will be able to do it if he has the necessary skilled personnel. Data communications professionals are among the most sought-after staff on the recruitment circuit. They are in very short supply.
 - *Specialist consultancies and systems houses* are the natural source of these skills outside one's own organisation. They therefore are likely to become important decision influencers in this emerging sector.
 - *Terminal manufacturers* can be knowledgeable if they specialise in this sector.
 - Many *PC "notebook computer" suppliers* are among the newest entrants to the industry and will for the most part have no applications expertise.

- To *office automation equipment suppliers* the software elements of a systems sale are becoming increasingly important as the intelligence and sophistication of office devices increases.
- This is a key issue for Motorola in choosing one or more vendors with whom to address this growing market, especially since the services element—software, consultancy and network subscription fees— will in five years outstrip the equipment element of this market.

Exhibit III-1 illustrates INPUT's segmentation diagram from this emerging sector. The chart shows which services will develop for the different types of users, and indicates the terminals and networks (in descending order of interest) to which each type of user needs to migrate.

EXHIBIT III-1

Types of Applications

	Consumer	Management/ Professions	Sales	Transportation	Emergency Services & Maintenance
Traditional Technologies	Payphones (voice only)	- Paging - Fixed network data comms	Payphone - Fixed network data comms	- Paging - PMR	- Paging - PMR
New Technologies - Terminals	- Touch tone telephones - Personal Fax	- Laptops - Personal Fax - Messaging terminals	- Laptops - Notebooks - Messaging terminals	- Specialist terminals - Hand-held computers	- Notebooks - Hand-held rugged computers
- Networks	- over Cellular - GSM	- over Cellular - MDN - GSM	- over Cellular - MDN	- PTMR - MDN	- PTMR - over Cellular - MDN - GSM

B

Market Forecasts

Exhibits III-2 to III-5 give INPUT's market forecasts for the mobile data communications market broken down a number of ways:

- Exhibits III-2 and III-3 illustrate the forecast subscriber base growth between 1991 and 1996 for Europe (including Eastern Europe) and for the world, respectively.

EXHIBIT III-2

European Market for Mobile Data Equipment Installed Base Forecast, 1991-1996

	Number of Subscribers (Thousands)					
	1991	1992	1993	1994	1995	1996
PMR Data	150	165	185	200	220	240
Dedicated Mobile Data (MDN)	10	15	25	50	90	140
Cellular						
- Digital	-	5	15	25	40	80
- Analogue	40	55	85	115	150	90

EXHIBIT III-3

Worldwide Market for Mobile Data Equipment Installed Base Forecast, 1991-1996

	Number of Subscribers (Thousands)					
	1991	1992	1993	1994	1995	1996
PMR Data	400	440	500	550	600	630
Dedicated Mobile Data (MDN)	18	35	65	120	250	400
Cellular						
- Digital	7	12	35	70	130	250
- Analogue	120	160	200	260	350	450

- Exhibits III-4 and III-5 convert this subscriber base into revenue terms in millions of US\$. See Appendix A for the economic assumptions built into INPUT's 1991 forecasts.

EXHIBIT III-4

**European Market for Mobile Data
Communications—Revenue Forecast,
1991-1996 for Equipment and Services**

	\$ Millions					
	1991	1992	1993	1994	1995	1996
PMR Data	20	20	20	20	20	20
Dedicated Mobile Data (MDN)	17	22	35	70	110	180
Cellular						
- Digital	-	4	17	28	45	85
- Analogue	20	25	40	52	67	77
Total	57	71	112	170	242	362

- All four tables are broken down between four subsectors:
 - Private mobile network including trunked radio networks such as the U.K. Band III system. Here the subscription revenue is estimated to be low and with steady migration of these users to new technologies, a fairly flat market is forecast.
 - Dedicated public networks such as the Mobitex and Hutchison systems provide (see profiles in Chapter IV)
 - Data over cellular - Digital, such as the upcoming GSM system
 - Data over cellular - Analogue, such as the existing analogue TACS and NMT systems can offer

EXHIBIT III-5

**Worldwide Market for Mobile Data
Communications—Revenue Forecast
1991-1996 for Equipment and Services**

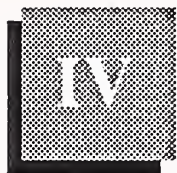
	\$ Millions					
	1991	1992	1993	1994	1995	1996
PMR Data	60	65	70	72	68	65
Dedicated Mobile Data (MDN)	20	30	55	130	260	500
Cellular						
- Digital	5	10	30	70	125	250
- Analogue	45	75	120	170	200	250
Total	130	180	275	342	653	1,065

- The revenues given in the last two tables include:
 - Subscriber equipment
 - Subscriber expenditure on services such as software, software support, consultancy, and network subscriptions



Competition





Competition

A

Overview

The market for publicly networked mobile data communications is very immature in all countries in Europe except the three Nordic countries of Sweden, Norway and Finland. This is in contrast to the Private Mobile Radio (PMR) market which has served the transportation, utilities and emergency services sector for several decades. These traditional users can be expected to migrate slowly from PMR to its trunked equivalent PTMR and to the new Mobile Data Networks (MDN) such as those offered by the Mobitex operators and the new dedicated networks (currently starting up in the U.K. and elsewhere). Eventual migration to the new GSM networks will commence soon but not at any significant pace. It will, however, be the final goal of users such as emergency services (the area in which the greatest functionality is required), as long as services can be provided as securely and as cheaply as the private equivalents.

New (i.e., since the advent of cellular) users will only migrate from voice to data or come straight onto mobile data usage slowly over the next five years. During this period users will be faced with a confusing variety of offerings and vendors will have difficulty in differentiating and focussing their services:

- The market will be served by a number of vendors offering network solutions.
- The tiered structure of the U.K. cellular market will act as a disincentive to service providers to get involved in mobile data solution sales.
- Vendors should prepare to talk directly to the educated data communications user.

B**Profiles of Existing
Players**

The research undertaken for this study included preparation of short profiles on some of the leading European suppliers of mobile data communications services as detailed on the following pages.

1. Hutchison Mobile Data (UK) Ltd

The Chase
John Tate Road
Foxholes Business Park
Hertford, Herts.
SG13 7NN, UK

Tel: +44 992 553318
Fax: +44 992 501056

Revenues: (FYE: 31.12.1990)
Nil

Hutchison Mobile Data (UK) Ltd (Hutchison Mobile) is a subsidiary of Hutchison Telecommunication (UK) Ltd (Hutchison Telecomms), which is itself part of the Retail, Telecommunications and Other Services division of the Hutchison Whampoa Limited group based in Hong Kong. The group had overall revenues in 1990 of over \$2 billion and Hutchison Telecomms (which operates paging, cellular voice and now also Telepoint services in the U.K.) achieved a turnover in the same period in excess of \$100 million.

Hutchison Mobile is one of the four companies licensed in 1990 by the U.K.'s Department of Trade and Industry (DTI) to operate a dedicated "data only" Mobile Data Network (MDN). It was the first of the four to launch a service in 1990.

The service was launched in its Phase 1 version covering London and the M25 area, Southern and Southeast England, the Midlands, Merseyside, Cumbria, Humberside, Southern Scotland and the Aberdeen region. Over 75% of the U.K. population is claimed to be covered from start-up. The technology is proprietary of Hutchison but has been developed in conjunction with Motorola Codex. Full U.K. coverage is targeted for 1993.

As a dedicated mobile data network, Hutchison Mobile is offering a full 2-way real-time connection. This will therefore be suitable for interactive applications such as database interrogation and calculation. Value-added voice services (such as voice-output weather and traffic reports) may be added at a later stage. Essentially the service is aimed at the business market and applications cited are:

- Field service engineers (e.g., for the AA)
- Couriers, dispatch and transportation firms
- Financial services sales forces (e.g., The Prudential Assurance company in the insurance sector)

The company is currently (August 1991) seeking “pilot” users and expects to have between 30 and 40 such before the year-end. No significant revenues are anticipated before 1992.

Distribution is principally through the direct sales force which is backed up by a small marketing team plus a group of applications consultants who are responsible for the specification of user requirements and solutions. The standard data input/output device is expected to be a “palmtop”—a hand-held terminal with LCD screen or a notebook computer with integral disk and screen. Devices chosen will be selected for application suitability.

Hutchison Mobile has a declared VAR (value-added reseller) policy which involves working with approved terminal device suppliers. Poqet Computer Corporation (a Fujitsu company), GRiD Computer (a Tandy subsidiary) and Telxon Corporation (the hand-held microcomputer vendor) were all mentioned as approved VARs.

The principal issues and trends quoted by this pioneering firm were:

- Increasing industry awareness of the technology
- Superiority of the public MDN solution due to the absence of voice and to the error rates associated with data over analogue cellular

Exhibit IV-1 summarises the Hutchison Mobile position.

EXHIBIT IV-1

Hutchison Mobile Key Parameters

- Part of a Mobile Communications group offering:
 - Paging
 - Cellular voice
 - Dedicated mobile data
 - Telepoint
- Part of a \$2 billion group
- National (75%) network coverage in the U.K.
- Corporate solutions selling through direct sales
- In-house application consultancy and support
- Partnerships with Laptop/Notebook computer companies (VARs)

2. Cognito Group Limited

Medway House
Newbury Business Park
London Road
NEWBURY, Berkshire
RG13 2PZ, UK

Tel: +44 635 508200
Fax: +44 635 550783

Revenues: (FYE: 31.3.1991)
Nil

Cognito Group Ltd (Cognito) is part of the Information Technology division of the Dowty group which is active in the aerospace, defence electronics and information systems markets. The division reports difficult trading conditions in 1990/91 with turnover only up 5% at the halfway stage. Nevertheless the last year accounts showed that £22 million (\$40 million) had been set aside to develop the new 2-way messaging network for the Cognito services which were launched on 1 July 1991.

The Cognito network had been set up as a result of Dowty's application to be a licence holder for the new U.K. Mobile Data Network licences (of which four were awarded by the DTI in 1990) with national coverage to be guaranteed by 1993. The service offered is the Emissary Service which allows for 2-way messaging between mobiles and in-house fixed users by a number of means:

- Two types of terminals are offered at the mobiles:
 - The Messenger terminal has been customised by Cognito for this network. It is hand-held, battery operated with a full Qwerty keyboard, a 160 character (4 lines x.40) display and an integral radio communicating via the network in TDMA digital mode
 - The RTU (Radio Terminating Unit) is used instead of the Messenger to connect to industry-standard laptops and other portables.
- Mobiles can communicate with the centre or with other mobiles. Fixed users in-house can send/receive messages through a standard PC running Cognito's Message Management Centre software, via a dial-up modem or leased line to access the network.

Cognito is strong in the hardware and customer service skills to operate this service. Loading of the system will be dependent on the effectiveness of the sales force and its ability to select easy target companies quickly. There is an active programme to approve terminal vendors and software developers to act as user-enabling organisations.

Being text-orientated the service will initially appeal to companies with fairly simple applications and short messages. However, the facility is there to develop more complex applications using custom or standard software.

Exhibit IV-2 lists the key features of Cognito's operation.

EXHIBIT IV-2**Cognito
Key Parameters**

- Part of the Dowty Information Technology (IT) division, marketing:
 - Data communications equipment and systems
- Dowty IT turnover approximately \$400 million in 1990
- Investing \$40 million in national mobile network
- Service is 2-way messaging - a form of mobile Electronic Mail - text orientated
- Integrated service - terminal hardware, network and software consultancy

3. The Mobitex System

The Mobitex system was developed by a joint venture between Ericsson Radio Systems AD and a subsidiary of Swedish Televerket (the Swedish PTO). It was developed initially with transportation applications in mind but having been in commercial operation in Scandinavia since 1987, it has already found acceptance with a range of users and applications:

- Taxi and haulage firms
- Bus companies
- Military uses for security of remote locations
- Forest industry operations

An estimate of over 3,000 subscriber companies and individuals using the systems in Sweden alone at the end of 1990 can be made. Each subscriber can have between one and 2,000 terminals depending on organisation size. For example the Swedish Post Office has several hundred terminals.

The Mobitex system has been implemented (or is in the process of being implemented) by five network operators to date:

- Swedish Televerket
- Norwegian Telecom
- Finnish Telecom
- RAM Mobile Data Ltd in the U.K.
- RAM Mobile Data Inc. in New York

A Canadian system is also planned.

Mobitex networks operate on a packet switching principle which allows for messages, data and alarm status/control signals to be stored if the recipient is not available to receive at a given transmission time. Text and data terminals are available on the Swedish network through four approved suppliers:

- Ericsson
- Philips
- Applicom (was Nokia Mobira)
- Mitsubishi (Gabilius is the Swedish distributor)

Mobitex radio systems allow for inclusion of:

- Voice handsets (now admitted by the Swedish network people to have been a mistake)
- Connections to satellite services

The U.K. systems being implemented currently are expected to open up the market considerably by comparison with the Nordic experience because:

- Spectrum allocation and channel width allow for faster data rates.
- Modern terminal units are more portable and thus will appeal to a wider base of subscribers.

4. Racal Vodata Limited

1 The Pentangle
Park Street
Newbury, Berkshire
RG13 1EA, UK

Tel: +44 635 33251
Fax: +44 635 528777

Revenues: (FYE: 31.3.1991)
Europe: \$5 million est. for equipment
and services in Europe (U.K.)

Racal Vodata Limited (Vodata) was set up at the same time as the Vodafone cellular network was established in 1985 when the two analogue cellular licences were granted in the U.K. Vodata acts as an arm's-length provider of value-added services on the Vodafone network, since the cellular network operators are not permitted to retail these services. Vodata markets through the network of over 30 local Service Providers.

The Vodafone network has current over 600,000 subscribers giving it an estimated 55% of the U.K. analogue cellular services market. Some 1% of these (not more than 6,000 subscribers) contributed to the mobile data market in the U.K. in 1990. This market consisted of specialist modem, terminal equipment and airtime sales for data transmitted over the public network.

In contrast to Cellnet, which has allowed its subscriber base to develop its own data interfaces and protocols, Vodafone early on established a protocol (CDLC or Cellular Data Link Control) based around IBM's data communications protocol, HDLC (High-level Data Link Control). The purpose of this work was to cater for data transmission over the fairly hostile environment of analogue mobile communications. The standard has been published and terminal suppliers are encouraged to provide interface equipment and software. Exhibit IV-3 summarises the key parameters of the Vodata activities in this field.

Vodata estimates that its data users are split between industrial and commercial users in roughly equal numbers. Industrial users include:

- British Rail for track testing and remote monitoring
- National Grid for data logging through portable equipment
- Bristol Water Company for monitoring of water pressure and levels

Commercial users include:

- Wheel-clamping service contractors in the London area
- ICL and HP with field services and field sales applications

Vodata CDLC modem standards have been adopted by a number of important cellular telephone suppliers, namely:

- NEC for use with its ProSpeed PCs and cellular telephones
- Mobira offering an interface to its Autoline and Talkman cellular phone ranges
- Panasonic offering compatibility with its C&E series of handsets

Vodata's services operate through something called VMACS which is incorporated into the Vodafone network and allows for a number of different in-house or third-party services to be accessed in the U.K. while on the move:

- PSTN Dial-up, known as 971 VMACS
- IBM's Business Network Services, BNS VMACS
- AT&T Istel's Infotrac Network
- Mercury's network services such as for electronic mail
- BT PSS Services
- In-house private data networks

Finally, Racal is extending its mobile data interests outside the U.K.:

- Telecom Australia and Millidyne in the USA have chosen the CDLC protocol for their data over cellular operations.
- Cellular activities are being pursued in France, Malta, Mexico and Sweden through joint ventures and equity stakes.
- Racal has entered a strategic alliance with Sweden's Ericsson to market and manufacture CT2 and GSM equipment through the vehicle of Orbitel.

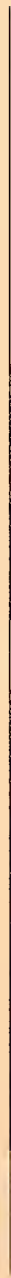
EXHIBIT IV-3

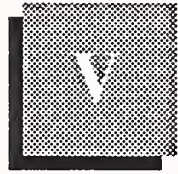
**Racal Vodata Limited
Key Parameters**

- The Value-Added Services arm of the Racal Telecom plc demerged group
- Operates at arm's length from Vodafone
- Offers a number of services:
 - Meterfone, Creditfone, Information Services
 - Vodafax and Creditfax are 1991 launches
- Leader in U.K. public mobile data market with its data over cellular facilities using the CDLC protocol
- CDLC an "open" interface



Market Development with Partners





Market Development with Partners

A

Choice of Partners

Exhibit V-1 lists the names and types of suppliers who were researched for this report. A number of the active players in the market have already been discussed in Chapter IV. This chapter details the five vendors who were selected for profiling, in order to illustrate the types of activities and cultures which could be involved in market sectors adjacent to that for mobile data.

The companies profiled (in short, 2- to 3-page profiles) were selected according to the following criteria, given in order:

- The type of adjacent sector, determined by product type:
 - Facsimile suppliers
 - Hand-held computer suppliers
 - Laptop or notebook computer suppliers
- Availability of information on the company
- Ability to illustrate the characteristics of their current adjacent sectors

We had intended to profile GRiD Computer, part of the Tandy Corporation, but information was not available in the short timescale on which we were operating. Therefore we substituted the smaller U.K.-based Husky Computer Limited as being the closest rival in terms of company characteristics.

EXHIBIT V-1

List of Vendor Companies Researched**1 Mobile Data Network Operators and Providers**

Cognito Group Ltd +
 RAM Mobile Data Ltd
 Hutchison Mobile Data (UK) Ltd +
 Swedish Televerket +
 Finnish Telekom
 Norwegian Telecom
 Ericsson Radio Systems +
 Racal Vodata Ltd +

2 Adjacent Market Vendors

2.1 Fax	2.2 Terminals	2.3 Laptop/Notebook Computers
Ricoh +	Victor	GRiD Computer
Samsung	Telxon +	Poqet Computer
TEC +	MSI	AST
Canon		Husky +
Olivetti		Dell Corporation
Sharp		Psion
Sagem		Toshiba
Amstrad		Compaq +
		Zenith

+ = Interviewed
 * = Profiled

(130 suppliers estimated to be active in this sector)

No attempt was made to rank the companies in terms of suitability as partners for Motorola or to recommend that any of them should be approached at this juncture.

B**Profiles of Potential Partners**

The following pages contain the five profiles produced. Further backup information is, of course, available on these companies through INPUT's London office.

Compaq Computer Corporation

20555 SH249
Houston, Texas 77070
USA

Tel: +1 (713) 370-0670

CEO: Joseph R. Canion, President

Revenues: (FYE: 31.12.1990)

Worldwide: \$3.6 billion

Europe: \$1.5 billion est.

The Company

Compaq was founded in 1982 and started the IBM PC-compatible industry. Now ranked 157th in the Fortune listing, it has grown in under 10 years to become an over \$3.5 billion organisation employing 11,400 staff worldwide. It is the largest company in the world which is dedicated solely to the production and marketing of personal computers (PCs).

Currently enjoying revenue growth in excess of 20% per annum (compared with a 9% average in the USA and Western Europe for the computer equipment market as a whole), Compaq nevertheless anticipates a slowing of growth during 1991 in its North American domestic markets. This slowdown is general to the industry but affects Compaq's PC sectors least, since both top-end PC-based servers and low-end notebook and laptop computers are enjoying increasing popularity and sales growth.

Compaq sells mainly through a network of 3,800 authorised dealers, of whom 1,600 are in Europe where they are served by 13 sales and marketing subsidiaries. Manufacture takes place in Houston, Texas, in Scotland, and in Singapore. Fifty-four percent of 1990 sales revenues came from non-U.S. business and an estimated 42% from Europe, including Eastern Europe. INPUT estimates that Compaq now has an installed base approaching 1 million units worldwide. Exhibit V-2 summarises Compaq as a company.

Product Range

Compaq markets:

- A family of PC-based servers - System Pro family
- A family of nine desktop PCs
- A range of six portable PCs including three "notebooks" which weigh between 6 and 7 pounds, three standard laptops weighing 14 pounds and a transportable high-performance machine weighing 20 pounds.

The notebook computers are at the industry's leading edge in the packaging of their circuitry to include monitor, keyboard, fixed and floppy disk drives and the processor electronics. Price range for the notebooks is from \$1,500 (USA pricing) to \$5,000. Exhibit V-3 summarises the product focus of Compaq.

Marketing and Partnership Potential

Conscious of its liability to be isolated by its distribution chain from the end users of its product, Compaq has in recent years, and in line with a strong industry trend, started to develop its own corporate sales team for marketing to large organisations. At the same time it has developed a strong multi-user UNIX capability by working closely with SCO (the Santa Cruz Operation), which is the industry leader in UNIX operating system software for PCs and minicomputers. More recently Compaq has established a joint integration agreement with a group of software systems vendors which also includes, besides SCO, Microsoft, the world's largest software product company; Novell, the de facto standard holder in the PC LAN market; and Banyan, another LAN operating system vendor. This agreement addresses the crucial challenge of providing robust, integrated, multi-user PC systems in the multivendor networked environment of the 1990s.

Exhibit V-4 lists INPUT's perceptions of Compaq as a partner to Motorola in the mobile wireless data communications area.

EXHIBIT V-2

Compaq Computer Key Parameters

- A \$3.6 billion PC manufacturing and marketing vendor—the world leader in the IBM PC-compatible sector.
- Employs over 11,400.
- Markets through 3,800 dealers worldwide across 66 countries.
- Dedicated to PCs from large multi-user servers down to notebook computers which fit in a briefcase.
- Offers MS-DOS and UNIX environments and the whole range of PC software running to tens of thousands of programs.

EXHIBIT V-3

Compaq Computer Product Focus

- PCs which are IBM-compatible
- Top end—System Pro range of servers
- Midrange—Desk Pro range of desktop machines
- Portables—laptops and notebooks with the same spectrum of power as the desktop models
- Has joint software integration agreements with:
 - Novell
 - Banyan
 - SCO
 - Microsoft

EXHIBIT V-4

Compaq as a Partner

Strengths (Advantages)	Weaknesses (Disadvantages)
• Leader in IBM PC-compatibles • Comprehensive product range of desktop and portable models • Worldwide presence • Units have standard data communications facilities for wired networks • Strong in R&D; innovative	• Chosen sectors reaching saturation—except for portables • No specific wireless communications capability • Relies on its dealer network • Must increasingly compete head-on with Japanese • No specific application experience

Husky Computer Ltd

PO Box 135
345 Foleshill Road
Coventry
CV6 5RK1

Tel: +44 203 668181
Fax: +44 203 680612

Revenues: (FYE: 31.3.1991)
Worldwide: \$60 million est
Europe: \$50 million est.

The Company

Husky Computer Ltd (Husky) is a pioneer in the development of rugged hand-held computers for industrial and military applications. The company claims to have marketed the world's first micro-computer-based, rugged, hand-held computer in 1981. Currently marketed machines weigh as little as 2 pounds and can be considered easily portable.

Like many pioneering U.K. electronics companies, Husky has opted to become a niche player in what is a technically demanding environment but one in which the competition has until now been reasonably weak. Husky's larger and principal rival is GRiD Computer (part of the Tandy Corporation) which is also, like Husky, present in North America and Europe.

Husky manufactures in the U.K. and has sales subsidiaries in France, Germany, the Netherlands and the USA. Its parent company is the little known Peek plc, an Abingdon, U.K.-based electronics group. Exhibit V-5 summarises the company's key characteristics.

Product Range

The four current models being marketed today reflect the company's pioneering origins.

- Two machines, the Husky Hawk and the Hunter 2 are based on the CP/M operating system which predates IBM PC-compatibility standards.
- The other two machines, the Hunter 16 and the Husky Wolf are MS-DOS based and have larger main memory (up to 4 Mbytes).

Compared to today's laptop and notebook computers, Husky devices have a long way to go to match capabilities in that no integral disk storage is offered. Husky units are, therefore, tightly focussed on markets where light weight and ruggedness are primary buying criteria and more important than calculation or data storage limits. Exhibit V-6 summarises the company's product focus.

Marketing and Partnership Potential

Husky markets its systems through a direct sales force and also works closely with specialist software houses which are active in its chosen markets. Many of its customers are large organisations with in-house software capability and customised solutions are normally installed with full support offered directly and/or through a network of distributors outside Europe or the USA.

Although Husky is far and away the smallest company profiled here, especially in comparison with Motorola's market leading stature, it should not be dismissed as irrelevant. Its challenges and concerns are those that operate at the user level in the day-to-day use of portable data processing computers. Husky is strong in just those areas of detail with which Motorola needs to be familiar to be successful in marketing solutions to mobile data communications users.

EXHIBIT V-5

Husky Computer Limited Key Parameters

- Subsidiary of the U.K.-owned Peek plc, an electronics group.
- Specialist in hand-held computers; claims a worldwide first in producing a rugged portable machine in 1981.
- U.K. manufacture; sales and marketing companies in the USA, the U.K., France and Germany.
- Track record in end-user solution selling.

EXHIBIT V-6

Husky Computer Limited Product Focus

- Specifically targets the ruggedised requirements sector of the hand-held market.

- Products include:

Husky Hawk—Lightweight CP/M-based machine, suitable for commercial applications and for software development

Hunter 2—A rugged CP/M-based machine weighing under 3 pounds

Hunter 16—A rugged MS/DOS machine

Husky Wolf—An MS/DOS hand-held aimed at military applications

EXHIBIT V-7

Husky as a Partner

Strengths (Advantages)	Weaknesses (Disadvantages)
• Understands hand-held applications; convenience factors rather than power • Proven track record in several vertical sectors of portable applications • Experience of communications and "outdoor" hostile environments • Military approval - USA & U.K.	• Devices are less powerful than standard notebooks • Small company; has investment needs • No mass marketing experience • Not aggressively growth orientated • Useful second-tier VAR

Ricoh Company Ltd

15-5 Minami-Aoyuma i-Chome
Minato-ku, Tokyo 107
Japan

Tel: +81 3-479-3111
Fax: +81 3-403-1578

CEO: Hiroshi Hamada, President

Revenues: (FYE: 31.3.1991)
Worldwide: \$5.29 billion
Europe: \$0.5 billion est.

The Company

In 1989 the Ricoh Company Ltd (Rico) celebrated the fiftieth year since its founding. Starting as a manufacturer of diazo sensitised paper, Ricoh has now developed into a maker of cameras, copiers and office automation equipment. With 1990-91 revenues in excess of \$5 billion and 37,000 staff it is ranked among the second level of Japanese "high-tech" electronics-based manufacturing companies. Overseas revenues amount to over 35% of the business.

Ricoh has extensive marketing and manufacturing capabilities in North America, Europe and Asia (outside Japan). In Japan the company markets through a network of branch sales companies and retailers and trading companies. There are some 600 service centres covering the full range of products.

In North America, Ricoh Corporation markets through a combination of direct sales forces (for large corporate customers) and the dealer network. The U.S. activity includes R&D facilities and day-to-day operations from marketing to services. The R&D work includes electronic device design and software for office applications and systems. Over 3,000 staff are employed in North America.

In Europe, plain paper copiers (PPCs) are produced in plants in France and the U.K. Facsimile devices and other office equipment are also made. R&D and service parts supply are also part of the French operation. Over 2,000 staff are employed in Europe.

Exhibit V-8 summarises the key parameters of the worldwide Ricoh organisation.

Product Range

Besides cameras and camera accessories, Ricoh's main focus is on providing the complete gamut of office equipment products for the modern automated office.

EXHIBIT V-6

Husky Computer Limited Product Focus

- Specifically targets the ruggedised requirements sector of the hand-held market.

- Products include:

Husky Hawk—Lightweight CP/M-based machine, suitable for commercial applications and for software development

Hunter 2—A rugged CP/M-based machine weighing under 3 pounds

Hunter 16—A rugged MS/DOS machine

Husky Wolf—An MS/DOS hand-held aimed at military applications

EXHIBIT V-7

Husky as a Partner

Strengths (Advantages)	Weaknesses (Disadvantages)
• Understands hand-held applications; convenience factors rather than power • Proven track record in several vertical sectors of portable applications • Experience of communications and "outdoor" hostile environments • Military approval - USA & U.K.	• Devices are less powerful than standard notebooks • Small company; has investment needs • No mass marketing experience • Not aggressively growth orientated • Useful second-tier VAR

- Word processors, PCs and servers
- Printers and copiers
- Facsimile and push-button telephones
- Microfilm and optical disk filing/archiving systems
- Hand-held and portable devices as well as desktop units

An increasing amount of intelligence is called for and found in all these devices. To provide standalone software capability, Ricoh is now marketing products derived from its in-house development work:

- Computer-aided design (CAD) software for workstations
- Database management and filing systems written in C for UNIX or MS-DOS environments

Exhibit V-9 summarises the Ricoh product range.

The principal product of interest to Motorola is the Ricoh FAX PF-1, a compact G3 facsimile unit designed for workers on the move, which operates through a cellular phone interface and is fully portable for use with a portable phone.

Marketing and Partnership Potential

Ricoh markets the bulk of its smaller and portable devices through a network of dealerships in each European country. In countries in which it does not have a sales subsidiary the channel hierarchy includes one or more distributors. Top end products will be increasingly sold through direct sales forces targeting larger business prospects.

Ricoh has substantial potential for partnership with Motorola in Europe, particularly in the data over cellular segment for individual sales to business executives and small businessmen. Exhibit V-10 summarises INPUT's view of the advantages/disadvantages of working with Ricoh.

EXHIBIT V-8

**Ricoh Company Ltd
Key Parameters**

- Over \$5 billion revenues worldwide
- Employs over 30,000 staff
- Present on all continents
 - Marketing
 - Manufacturing
- In Europe with subsidiaries in
 - France
 - Germany
 - Netherlands
 - Spain
 - Switzerland
 - U.K.

EXHIBIT V-9

Ricoh Company Ltd Product Focus

- Office Automation (OA) products for:
 - Text Preparation—WPs, laptops, PCs up to full workstations
 - Reproduction—copiers (PPCs), laser printers now with digital intelligence
 - Communications—facsimile (plain paper up to G4), personal, mobile and office
 - Information storage and retrieval:
 - Microfilm systems
 - Optical filing systems
 - Personal products—fax, copiers, electronic memo pad
- Cameras and accessories—the historical roots of the company
- Software products—CAD, DBMS, filing (UNIX and C)

EXHIBIT V-10

Ricoh Company Ltd as a Partner

Strengths (Advantages)	Weaknesses (Disadvantages)
• Sizeable • Usual Japanese strength in manufacturing • Complementary products • Suitable for pursuit of personal-oriented sector • Software and consultancy strengths are building	• Could become competitive • Next technology leap—can they make it?

Telxon Corporation

World Headquarters

3330 West Market Street
PO Box 5582
Akron, Ohio 44334-0582
USA

Tel: +1 (800) 800 8001

CEO: Raymond D. Moyo,
President

Revenues: (FYE: 31.3.1991)
Worldwide: \$185 million
Europe: \$42 million est.

The Company

Telxon Corporation (Telxon) is a leading company in the field of application-specific hand-held computing devices. The company started in the area of portable data capture units and with the increase in the embedded intelligence in these systems, it can now claim to be "the worldwide leader in application-specific portable distributed computing systems." It can be clearly differentiated from vendors of general-purpose notebook/laptop computers by a number of characteristics:

- Its target markets are industry-specific, e.g., retail, distribution or health care.
- Its portable devices are sold into specification applications.
- It sells in its major country markets through its own direct sales force as well as through dealers, although in many countries it markets via a network of distributors.
- In all countries VARs are an additional channel for increasing sales penetration. VARs are software houses and systems integrators who understand the application-driven nature of the market for portable devices.

Telxon employs 1,300 staff, is represented in 50 countries, gained 34% of fiscal 1991 revenues (\$62 million) from overseas, and claims:

- 5,000 customers worldwide
- 31% of the U.S market for hand-held data capture computers
- Over 85% of the major retail chains in the USA as its customers

Exhibit V-11 summarises the key parameters of the Telxon organisation.

Product Range

Telxon is currently marketing a range of 10 PTCs with increasing amounts of memory, displayed area and computing capability as one goes up the range. The equally essential part of the product is the software capability:

- Development tools
- Industry standard operating system environment (Micro Foot-print is Telxon's version of MS-DOS for the PTC environment)
- Communications capability
- Software support

Exhibit V-12 summarises Telxon's product and service capabilities.

Applications in which Telxon has in-depth experience are:

- Sales order entry
- Stock ordering and replenishment
- Field service reporting, dispatching and spares location
- Warehousing picking and placing
- Market research
- Hospital ward processing
- Meter reading

Industry sectors in which Telxon is highly visible are:

- Retail and wholesale distribution
- Utilities
- Health care
- Marketing services

Marketing and Partnership Potential

Telxon's main distribution channel is through its network of distributors and VARs. The value of its units (which range from \$200 up to \$1,000 each, but are sold in large, discountable quantities) does not allow a large direct sales force to be supported. Sales personnel are largely occupied in servicing the distributor and VAR network.

OEM marketing and product managers look after the sales support and customer service requirements of the OEMs/VARs. Field servicing of the units is mainly via the return to workshop method with spare units being held either by the end user or the dealer/VAR.

Exhibit V-13 illustrates Telxon's strengths and weaknesses as a partner.

EXHIBIT V-11

**Telxon Corporation
Key Parameters**

- \$185 million (1990/91) revenues worldwide
- Market leadership in its chosen sector
- Represented in 50 countries, with subsidiaries in: Australia, Belgium, Canada, France, Germany, Italy and the U.K.
- Restructured after 1990 strategic review following a loss-making fiscal 1990
- Markets through variety of sales channels
- Familiar with radio data communications

EXHIBIT V-12

**Telxon Corporation
Product Focus**

- Hand-held microcomputer-based portable tele-transaction computers (PTCs)
- MS-DOS-based application software:
 - Developed using TCAL—a proprietary set of application development tools
 - Resident in user interchangeable ROM cartridges
- Range of ancillary input/output units
 - Bar code scanners, portable printers
- Communications capability
 - Fixed and mobile, LAN and WAN
- Full software and service support plan

EXHIBIT V-13

Telxon Corporation as a Partner

Strengths (Advantages)	Weaknesses (Disadvantages)
• Knowledge of data capture markets and applications • Software capability • Proven track record in chosen sectors • Communications capabilities - both wired and wireless • Full range of products in its chosen sectors	• Small size (by Motorola standards) - Niche preoccupations - Lack of direct sales capability - System enabler rather than a systems integrator (this could be viewed as a strength)

Tokyo Electric Company Ltd

Peripheral & Office Automation
Equipment Group
1-14-10, Uchikanda
Chiyoda-Ku, Tokyo 101
Japan

CEO: Jun Kobayashi, President

Tel: +81.3.3292 1011
Fax: +81.3.3292 6440

Revenues: (FYE: 31.3.1990)
Worldwide: \$1.3 billion
Europe: \$0.2 billion est.

The Company

As a subsidiary of one of Japan's largest concerns, the Toshiba group, Tokyo Electric Company Ltd (known as TEC) does not have very high visibility in its own right. Employing over 5,000 staff, it has focused on three main lines of business:

- Retail systems
- Computer peripherals and office automation
- Electric appliances and lighting

TEC pursues a policy of manufacturing excellence in the Japanese tradition, and believes that a key element of this policy is the vertical integration of electronic and electro-mechanical components and sub-assemblies made in its own plants into its end products.

Established in 1950 as a producer of lighting fixtures and office machines, the company branched out into consumer electrical appliances in one direction and in the other direction, in the 1970s, increased its commitment to the business field by starting to manufacture electronic cash registers and other electro-mechanical POS equipment. Finally, later in the 1970s it entered the production of matrix and laser beam printers and facsimile equipment.

Worldwide sales reached \$1.3 billion in fiscal 1990. Exhibit V-14 summarises TEC's key parameters.

Product Range

Besides the extensive range of peripheral and terminal equipment already outlined, TEC has become involved in software development and systems integration, mainly in answer to the needs of its retail automation activities. The retail sector requirements involve being able to provide all the parts of a large distributed system on a turnkey basis.

- Central and distributed computing power
- Software for terminals and in-store controllers
- Project management and installation skills

Of particular interest to this study are the two portable facsimile units—PN-1300 and PN-1400—which are suitable for use via the fixed network or via a cellular phone interface. These are A4 units weighing 3.3 pounds and just under 4 pounds, respectively. The PN-1300 is recommended as especially useful for connection while travelling in plane, car, train, etc.

Exhibit V-15 lists TEC's product lines and focus.

Marketing and Partnership Potential

TEC markets its products principally through a distribution chain of distributors and dealers. Many office automation devices are sold to OEMs for incorporation into their final systems. The company offers full customer service, support, maintenance and training facilities and has subsidiaries in North America, Europe, Australia and Asia carrying out these functions.

As a partner it can offer the massive financial strength of its parent group. Exhibit V-16 summarises its strengths and weaknesses as a partner.

EXHIBIT V-14

Tokyo Electric Company (TEC) Key Parameters

- Toshiba group subsidiary
- Worldwide 1989-90 revenues of \$1.3 billion
- Employs over 5,000 staff
- Focuses on applying electronics to business and consumer appliances
- Present in Asia, North America and Europe
- Develops software for its systems in Japan, USA and Europe

EXHIBIT V-15

Tokyo Electric Company (TEC) Product Focus

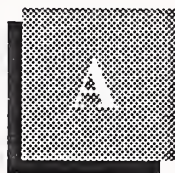
- Lines of business
 - Retail terminals and systems
 - Computer peripherals—matrix and laser printers, ticket printers
 - Office automation equipment—fax, post office automation systems, invoicing systems
- Software and systems integration capabilities
- Balanced expertise in electronic and electro-mechanical parts manufacture

EXHIBIT V-16

Tokyo Electric Company (TEC) as a Partner

Strengths (Advantages)	Weaknesses (Disadvantages)
• Medium size but with the financial strength of its parent company • Dedicated to high-quality precision engineering • Understands needs of small businessman and/or consumer • Software and systems integration skills	• Not sales-outlet-orientated • No specific mobile communications experience • TEC name not known—should become known as Toshiba

Appendix



Appendix: Economic Assumptions

This section includes some notes on the methodology INPUT uses in making forecasts and judging how reasonable they are.

INPUT reports are based principally on three strands of research activity conducted throughout the year:

- A vendor research programme with more than 300 interviews with prominent software and services vendors across Europe. This research assesses their attributable revenues in each country by delivery mode and, where possible, by industry sector. INPUT consultants use their own judgement in many cases to categorise revenues into subsectors. In particular, INPUT excludes revenues considered captive, such as those from a vendor's parent company.
- Several hundred vendor and user interviews across all European market sectors to determine trends and opinions. These interviews are part of the research that INPUT carries out in specific sectors of the software and services market. In 1990, for example, INPUT produced reports on over 20 different software and services market sectors.
- Additionally, INPUT maintains an extensive library and database of information relating to the software and services industry. This covers, for example, INPUT's Customer Services Programme data: results of INPUT's research into the hardware maintenance market, which includes diversification into the software and services market.

All the forecasts from these activities are produced in local currency for each country, then consolidated with common economic and exchange rate data to produce a top level forecast. This is done for software and services in each country and in Europe as a whole. At each stage it is

examined for reasonableness and consistency and, if necessary, revised. For example, INPUT satisfactorily tested the question: Will predicted user budgets for information systems support the predicted high growth rates in software and services?

The forecasts also benefit from assignments for and feedback from INPUT clients, which include over 100 of the leading vendors of software and services around the world. For example: INPUT supplied an economic model to a market leading client on the potential effect of rising oil prices on forecast software and services growth rates. In summary, this showed that falling real growth was largely counterbalanced by increases in inflation, resulting in continued high dollar growth forecasts for the market.

In order to consolidate INPUT's forecasts and vendor data into a consistent set of European analyses each year, it is essential to use a standard set of economic factors. The following pages show the inflation and exchange rates currently in use.

A

**European Exchange
Rates**

The following table, Exhibit A-1, shows the standard exchange rates used throughout the 1991 programme to consolidate country market data for overall Western European forecasts and vendor market shares.

EXHIBIT A-1

U.S. Dollar and ECU Exchange Rates 1991

Country	Currency	U.S. Dollar Exchange Rate	ECU Exchange Rate
France	FF	5.65	7.74
Germany	DM	1.68	2.30
United Kingdom	£	0.515	0.704
Italy	Lira	1,233.0	1,689.0
Sweden	Sek	5.61	7.69
Denmark	DK	6.39	8.75
Norway	NK	6.49	8.89
Finland	FM	3.96	5.43
Netherlands	Dfl	1.69	2.32
Belgium	BF	34.60	47.40
Switzerland	SF	1.27	1.74
Austria	Sch	11.80	16.17
Spain	Ptas	95.0	130.12
	\$	1	1.37

Source: Barclays Bank (Q4 1990)

Exhibit A-2 shows the standard exchange rates used throughout the 1990 programmes to consolidate country market data for overall Western European forecasts and vendor market shares.

EXHIBIT A-2

U.S. Dollar and ECU Exchange Rates 1990

Country	Currency	U.S. Dollar Exchange Rate	ECU Exchange Rate
France	FF	6.17	6.87
Germany	DM	1.81	2.05
United Kingdom	£	0.631	0.74
Italy	Lira	1,336.0	1,502.0
Sweden	Sek	6.39	7.41
Denmark	DK	7.05	7.8
Norway	NK	6.85	7.94
Finland	FM	4.21	4.84
Netherlands	Dfl	2.05	2.3
Belgium	BF	38.06	42.29
Switzerland	SF	1.61	1.8
Austria	Sch	12.77	14.39
Spain	Ptas	115.8	129.7
	\$	1	1.20

Source: Exchange rates - Barclays Bank (1989)

B

European Inflation Rates

Exhibit A-3 shows the average five-year inflation assumptions for each reported country and the changes from those used in reports produced in the previous year. All INPUT forecasts include the effects of inflation as well as natural market growth rates. For consistency, the same inflation rates are used throughout all market sector research and analysis during a calendar year, unless specified otherwise.

EXHIBIT A-3

Inflation Assumptions, 1990 and 1991

Country	Assumption 1990-1995	Assumption 1991-1996	Change
France	4.5	3.0	-1.5
Germany	4.0	2.7	-1.3
United Kingdom	7.0	4.8	-2.2
Italy	7.0	4.4	-2.6
Sweden	7.0	6.3	-0.7
Denmark	5.0	2.7	-2.3
Norway	5.0	4.9	-0.1
Finland	6.0	5.0	-1.0
Netherlands	3.0	2.4	-0.6
Belgium	4.0	3.3	-0.7
Switzerland	5.0	3.3	-1.7
Austria	4.0	2.6	-1.3
Spain	6.5	4.7	-1.8
Rest of Europe	10.0	7.7	-2.5
European Average	5.5	4.0	-1.5

Sources: OECD 1991 Forecast
IMF 1989

Exhibit A-4 shows the inflation assumptions for both the 1989 and 1990 research programmes.

EXHIBIT A-4

Inflation Assumptions, 1989 and 1990			
Country	Assumption 1989-1994	Assumption 1990-1995	Change
France	4.0	4.5	+0.5
Germany	2.5	4.0	+1.5
United Kingdom	5.5	7.0	+1.5
Italy	6.0	7.0	+1.0
Sweden	6.0	7.0	+1.0
Denmark	6.0	5.0	-1.0
Norway	4.0	5.0	+1.0
Finland	6.0	6.0	0.0
Netherlands	2.0	3.0	+1.0
Belgium	3.5	4.0	+0.5
Switzerland	2.5	5.0	+2.5
Austria	3.0	4.0	+1.0
Spain	5.5	6.5	+1.0
Rest of Europe	8.0	10.0	+2.0
European Average	4.5	5.5	+1.0

Source: IMF 1989

